

## 4 Steam Power Introduced

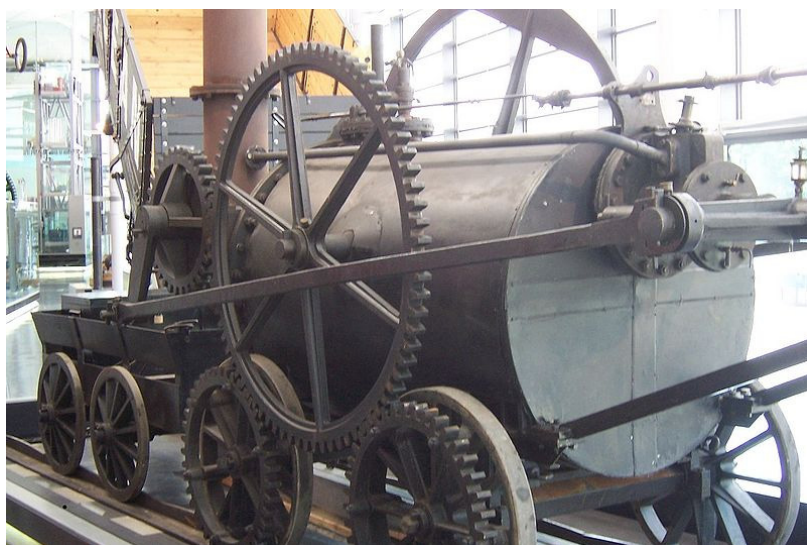
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James Watt, a Scottish inventor and mechanical engineer, was responsible for improvements to the steam engine of Thomas Newcomen, before used to pump water out of mines. Watt developed a reciprocating engine, capable of powering a wheel. Although the Watt engine powered cotton mills and a variety of machinery, it was a large stationary engine.

The first working model of a steam rail locomotive was designed and constructed by John Fitch in the United States in 1794.

The first full scale working railway steam locomotive was built in the United Kingdom in 1804 by Richard Trevithick, an English engineer born in Cornwall (the story goes that it was constructed to satisfy a bet by Samuel Homfray, the local iron master). This used high pressure steam to drive the engine by one power stroke (the transmission system employed a large fly-wheel to even out the action of the piston rod) (Figure 8).

On February 21, 1804 Trevithick's engine hauled 10 tons of iron and 70 men nearly ten miles from Penydarren, South Wales at a speed of five miles-per-hour. Trevithick later demonstrated a locomotive operating upon a piece of circular rail

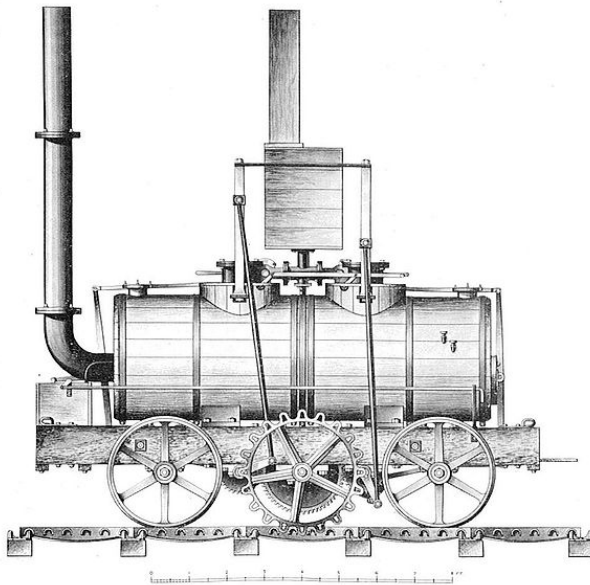


**Fig. 8** A replica of Trevithick's engine at the National Waterfront Museum, Swansea

track in Bloomsbury, London, the "Catch-Me-Who-Can", but never got beyond the experimental stage with railway locomotives, not least because his engines were too heavy for the cast-iron platelay track then in use. Despite his inventive talents, Richard Trevithick died in poverty, with his achievement being largely unrecognized.

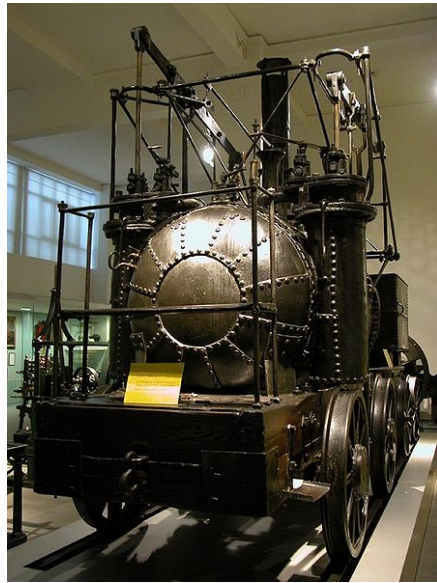
The impact of the Napoleonic Wars resulted in (amongst other things) a dramatic rise in the price of fodder. This was the imperative that made the locomotive an economic proposition, if it could be perfected.

The first commercially successful steam locomotive was Matthew Murray's rack locomotive Salamanca built for the narrow gauge Middleton Railway in 1812 (Figure 9). This twin cylinder locomotive was not heavy enough to break the edge-rails track, and solved the problem of adhesion by a cog-wheel utilising teeth cast on the side of one of the rails. It was the first rack railway.

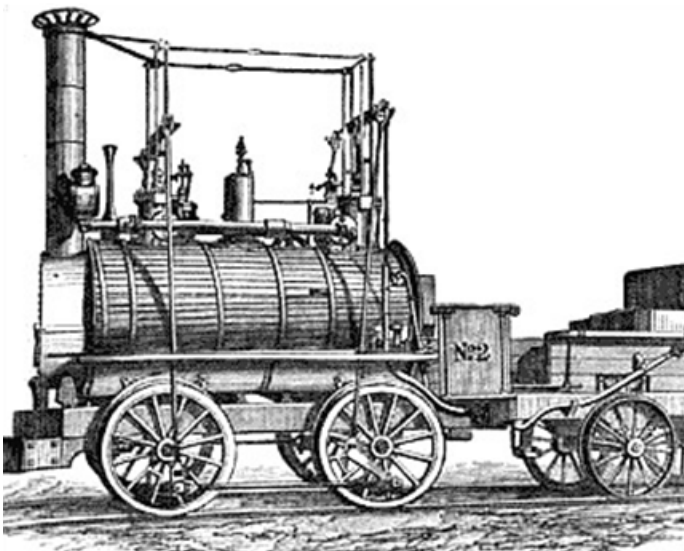


**Fig. 9** Salamanca, the first commercially successful steam locomotive, built in 1812 by Matthew Murray of Holbeck

This was followed in 1813 by the Puffing Billy built by Christopher Blackett and William Hedley for the Wylam Colliery Railway, the first successful locomotive running by adhesion only. This was accomplished by the distribution of weight by a number of wheels. Puffing Billy is now on display in the Science Museum in London, the oldest locomotive in existence (Figure 10).



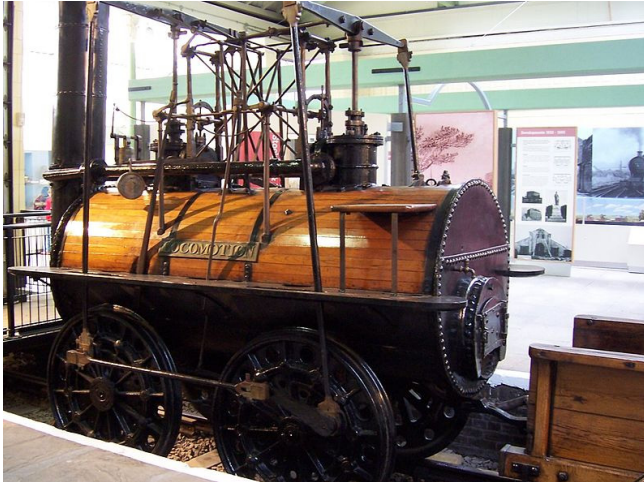
**Fig. 10** Puffing Billy as seen from the front (1813-1814)



**Fig. 11** Blücher engine

In 1814 George Stephenson, inspired by the early locomotives of Trevithick, Murray and Hedley, persuaded the manager of the Killingworth colliery where he worked to allow him to build a steam-powered machine. He built the Blücher, one of the first successful flanged-wheel adhesion locomotives (Figure 11).

Stephenson played a pivotal role in the development and widespread adoption of the steam locomotive. His designs considerably improved on the work of the earlier pioneers. In 1825 he built the Locomotion for the Stockton and Darlington Railway, north east England, which was the first public steam railway in the world (Figure 12). Such success led to Stephenson establishing his company as the pre-eminent builder of steam locomotives used on railways in the United Kingdom, United States and much of Europe.



**Fig. 12** Locomotion (at Darlington Railway Centre and Museum)